March 15, 2024

Mark Walters
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1325 4th Avenue,
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Dear Attorney Walters:

As you are aware, I have been retained in the matter of *Khalid v. Microsoft*, in King County Superior Court to answer specific questions related to technology aspects of this litigation. This letter forms an update to my previous letter of February 8, 2024; there are no changes in my opinions expressed in that letter, but I have also opined about other specific questions that I have been asked about.

In my role, I act as a neutral party providing my expert evaluation of the evidence I am asked to review. I have no interest in the outcome of the case, and I have no personal relationship with any of the parties involved. In reviewing the materials, I have provided my opinion of the evidence based upon my education, experience, and knowledge in the technology industry. I have provided a copy of my current CV and litigation history along with this letter.

Please note that this letter is not a full report. Thus, I have done a preliminary analysis of the questions and the information available to me and provided my preliminary analysis based upon the information reviewed.

I have been asked to address the following questions:

- Do the three reviewed patents:
    1. Appear to be valid?
    2. Relate to the gaming console and/or cloud gaming fields?
    3. Appear to have commercial benefits; and
    4. Have any evidence that the teachings of the patents are being practiced by anyone other than the plaintiff.
- Is there any evidence that the e-mail headers provided to me for analysis are not valid e-mail headers?
- Is there any evidence that a URI provided to me, which purportedly came from a no-longer functioning version of the US Patent and Trademark Office website, would not have been valid when it was generated?
- What, if any, are ordinary rules regarding retention of electronic records in e-mail systems?

Patents

I have not exhaustively evaluated the patents for validity. Instead, I have assumed that the patents are, as issued, valid and that should the parties engage in litigation in the future about patent infringement a complete analysis of them will be required.

In the current case, I have been asked to evaluate the patents, determine if they apply to game console emulation and cloud gaming, and if so, to identify potential parties that may be infringing these patents.

The three patents that I have reviewed are: 8,782,637, 10,846,118, and 8,286,219. I have obtained copies of those patents and the patent files from the USPTO's patent service. I have done a cursory review of the file records and have considered the patents and how they apply to: (1) game console emulation, such as is sometimes used to allow older console games to play on newer consoles, and (2) cloud gaming. These techniques are tied to a general concept known as *virtualization.*

Virtualization is not a new concept – IBM first proposed building products with full hardware virtualization in 1967 and commercially shipped their first fully virtual system in 1972. This was the basis of the VM/CMS operating system that was used on IBM mainframes, and a variant of it is still used to this day.

Microprocessors did not have sufficient processing power to provide virtualization support. The first notable Intel CPU with virtualization was the 80386, which introduced the concept of a "virtual 8086". This was, in fact, a "backwards compatibility solution" to allow programs that could not run in the protected mode of the 80386 CPU (a full 4GB virtual address space) to operate in a special environment where the running program behaved as if it were running on the older Intel CPU. While there were significant limitations to this virtualization, it provided the seed of hardware virtualization on Intel CPUs that ultimately culminated in the introduction of hardware supported virtualization. Early companies, including VMWare (now a subsidiary of Broadcom) and Xen, achieved this by providing partial hardware virtualization and implementing software mechanisms to overcome the limitations of Intel hardware.

Intel introduced hardware assisted virtualization (VX-x) in 2005, and AMD introduced hardware assisted virtualization (AMD-V) in 2006. These early hardware virtualization mechanisms had significant limitations, including in terms of performance, and thus were not used in performance critical usage scenarios. However, both Intel and AMD have enhanced their hardware virtualization to permit its use in high-performance demanding environments. In the timeframe of the two older patents filing (2008 and 2010), Intel processor hardware virtualization technology was making the key steps that were required to enabling its broader use for performance critical virtualization: 2008 was the introduction of Extended Page Tables (a mechanism to improve performance of address translations in virtualized machines,) 2010 allowed running logical processors in real mode (which required EPT). It isn't until 2013 that Intel introduced greater support for nested virtual machines (that is a virtual machine running within another virtual machine.)

The reason I have provided this historical background is to explain that the older two patents were forward-looking relative to the state of the actual hardware capabilities at the time the patents were filed.

As the industry has progressed, earlier alternatives to hardware virtualization have largely disappeared due to their complexity and technological limitations.

The primary benefit of virtualization in data centers, which is directly applicable to cloud gaming, is that it provides highly flexible scaling of services. Increased demand can often be satisfied simply by creating a new "virtual machine." This flexibility has led to the rise of large service providers including Amazon, Microsoft, IBM, and Google. These companies constantly look for new ways to increase the flexibility and support of their service centers. For example, to support an Xbox 360 emulator inside an Azure data center does not require installing any Xbox hardware – it merely requires creating a virtual machine that provides the capabilities of the Xbox hardware. The graphics elements are then compressed and sent to a client device.

There are significant benefits to this approach: dynamic flexibility in scaling services to satisfy instant demand, the use of a combination of commodity and customized hardware, and the ability to introduce optimizations that are simply impossible if the game console is inside an end-user's entertainment room.

In considering these patents and their potential use by third parties, I have identified four companies that appear to be using virtualization-based solutions consistent with the claims of the patents. They are:

- Sony. Their PS3 platform was based on the cell processor, which was a descendant of the Power PC processor, it is not an Intel-compatible CPU. To make PS3 games work on subsequent platforms was most easily implemented using a virtual machine that emulated the cell processor instruction set. Other alternatives would have been more expensive and less flexible. While it is possible Sony used a virtualization solution for PS4 to PS5 compatibility, there is insufficient public information to determine if this is, in fact, the case.

- Microsoft. Their original Xbox console was based on an Intel CPU, while their second-generation console, Xbox 360 used a PowerPC based CPU architecture, which was not compatible with their previous Intel CPU architecture. In addition, their GPU architecture changed from an Nvidia processor to an ATI (now AMD) processor. Thus, to run legacy games, Microsoft had to create an efficient mechanism for emulating the previous game console, both in terms of its CPU and GPU. This is most easily accomplished using virtualization techniques. Other techniques would have been more expensive and offered less performance. Note, that I have not reviewed the Xbox 360 software and hardware to confirm that they use virtualization. In addition, Microsoft's foray into cloud gaming is based upon normal data center service models, which include providing both specialized hardware and software via virtual machines. Microsoft is increasingly depending upon cloud gaming services to extend their market share, with industry expectations that Microsoft will announce support for cloud gaming on Sony consoles; this is in keeping with the concessions they made as part of their recent Activision/Blizzard acquisition. I also note that in Microsoft's earning report as of January 30, 2024, the gaming division now earns more revenue than the Windows division, for the first time in company history.
- Amazon. Amazon Luna is a cloud gaming service. Such services will, as a matter of efficiency, use a virtual machine mechanism to isolate game players from each other, as well as to provide flexible scaling of services based upon demand. The ability to play a game on one console from another console is not new – the existing consoles from Sony and Microsoft have provided backwards compatibility – but the bulk of revenue in the gaming field is from the games, not the hardware that is used to display them. Amazon does not have a gaming console, instead their games are played on a variety of end-user devices. This general trend of decoupling the games from the end-user device is clearly a byproduct of the benefits of virtualization – the virtual machine can create whatever environment is needed for the game, while the graphics are displayed on the end-user device.

- Nvidia. Nvidia GeForce Now provides a large collection of games that are run on Nvidia's own cloud gaming platform and then displayed on the end-user devices. While I have not reviewed the technical implementation of the Nvidia service, given its structure as a cloud service offering, it is reasonable to expect that their implementation will use normal data center techniques for virtualizing services. This allows numerous users to play games simultaneously, with the appearance that each one is running on their own machine – this is the very essence of virtualization.

In addition, I found at least one public project that allows running PS5 games on Windows and Mac OS, which also incorporates the methods taught in the patents. See https://pcsx5.org, which says: "PCSX5 is a beta PlayStation 5 emulator project based on hardware-assisted virtualization which allows you to play PS4 and PS5 games on your PC & macOS. It requires your PS5 console to grab "play-station device identifier" (PDIX) and original PS4 / PS5 games." I note that this is consistent with my observation that using virtualization is the simplest and most effective way to implement this functionality – if there were an easier way, an open-source project like this would have used it.

The cloud gaming space is a rapidly growing one. According to Fortune Business Insights, the consolidated annual growth rate (CAGR) from 2023 to 2030 is projected to be 39.46%, which moves from a $5.76 billion market in 2022 to an $84.97 billion market in 2030. It is difficult to imagine this level of growth if the industry needed to find an alternative to the virtualization mechanisms that are routinely used today.

Thus, based upon my review of the information available to me,

- The patents appear to be technically sound.
- The patents appear to read onto the common implementation models for console emulation in both end-user console devices ("backwards compatibility" for old game support) and for enabling end user devices to play games that are emulated in the cloud, with an end-user device interacting with the cloud service via the internet.

- I am not aware of any alternatives to the virtual machine model that we use today to implement this type of functionality.
- The claims of the '637 and '118 patents describe techniques that are consistent with publicly available information from Microsoft. Without using these technologies, Microsoft would need to explore alternatives that are less efficient and more expensive.
- The clouding of the title of these patents materially impairs the ability to assert them, which means that the owner has lost substantial value.
- The value of these patents moving forward, as part of the increased growth of cloud gaming, means that the techniques taught by these patents have significant potential to grow in value. A $90 billion market is a truly lucrative one for the licensing of critical technology, as these patents represent. Thus, I would expect the patent owner to license these patents on reasonable terms to Amazon, Microsoft, Sony, Nvidia, and other companies participating in both console and cloud gaming businesses, which seem to be converging.

E-mail Headers

I was provided an email, with the subject line "RE: RE:background check doc" dated December 19, 2011, containing inventionlist.doc as an attachment. The e-mail headers shown in Plaintiffs' Third Set of Requests for Production, pages 14-15. I was asked to review the headers to determine if there was any evidence the headers are not valid.

Background

I have been involved in the handling of RFC 822 e-mail servers since 1987, including numerous versions of Microsoft's own Exchange Server. The basics of e-mail handling have not changed, though the details continue to evolve as we strive to enhance e-mail security.

1. When an email is sent, the sender's email client or server creates the initial header fields, such as "From," "To," "Subject," and "Date." These fields provide basic information about the email.

2. The sender's email server then adds its own metadata to the header, typically in the form of a "Received" field. This field includes information like the server's hostname, timestamp, and the protocol used to receive the message (e.g., SMTP).

3. As the email travels from the sender's server to the recipient's server, it may pass through several intermediate servers, such as mail transfer agents (MTAs) and/or spam filters. Each of these servers adds its own "Received" field to the header, recording its hostname, timestamp, and any additional processing information.

4. Other header fields may be added or modified along the way, such as "Return-Path" (specifying the email address for bounce messages), "Message-ID" (a unique identifier for the email), and "MIME-Version" (indicating the version of the MIME standard used for encoding attachments).

5. When the email reaches the recipient's server, a final "Received" field is added, indicating the server that delivered the message to the recipient's mailbox.

7. The recipient's email client then retrieves the email from the server and displays the header information, typically showing only the most relevant fields like "From," "To," "Subject," and "Date." However, the full header, including all the "Received" fields and other metadata, can usually be viewed by the user if desired.

By examining the “Received” fields in the complete e-mail header, I can trace the route an email took from the sender to the recipient. This information is collected because it is useful for troubleshooting delivery issues or investigating the source of spam or phishing emails.

My examination was structured to test a null hypothesis: "the headers in this e-mail are inconsistent." Inconsistencies arise when headers are out of order, there are significant gaps in the timing, there are discontinuities in the hand-off between servers, etc. After a review of these headers, I could not identify any inconsistencies and thus I rejected the null hypothesis.

I then turned my attention to specific details that might suggest these headers are unlikely to be forged. Two internal server names stood out to me:

- TK5EX14HUBC104.redmond.corp.microsoft.com
- TK5EX14MBXC252.redmond.corp.microsoft.com

By using the names of these servers, I was able to find independent uses of both server names in public facing archives both before and after 2011. In all of the cases I found, these server names were used by individuals with Microsoft corporate (@microsoft.com) e-mail addresses. The websites where I found them were for standards organizations (W3C, IETF, and the Python Developer's group) that are not controlled by any of the parties to this litigation.

I also reviewed the IP addresses being reported for these two servers: two are valid IP addresses and the one is an invalid or internal use only IP address. Of the two externally facing IP addresses that I evaluated (157.54.80.25 and 131.107.125.8) both were registered to Microsoft corporation, beginning in the 1990s and continuing to today.

Based upon my own search of those two server's names (the portion before ".redmond.corp.microsoft.com") they were both legitimate names. Neither of these two names was widely known or available and thus it seems unlikely they would be easily discovered. Thus, based upon my analysis, the most likely conclusion is that these headers are legitimate and were generated during the ordinary course of delivering e-mail correspondence from Microsoft to Xencare.com.

USPTO Links

I was provided with an e-mail to Microsoft with the resume of ATM Shafiqul Khalid attached to it as a Microsoft Word document in the old (DOC) format. That included an embedded link to the USPTO website, which I was asked to analyze, with the proviso that it was a valid link in 2011. I rely upon both my personal knowledge of changes there – I used the USPTO website in this period of time and continue to use it currently – as well as an analysis of the structure of USPTO links that I was able to both find and generate.

The URL that I was asked to review is:

http://appft1.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&p=1&u=%2Fnetahtml%2FPTO%2Fsearch-bool.html&r=0&f=S&l=50&TERM1=shafiqul&FIELD1=&co1=AND&TERM2=khalid&FIELD2=&d=PG01

I note that this URL is to search all publish patent application that included "Shafiqul" and "khalid". The link is no longer working, due to a significant change to the USPTO website in the intervening years.

Background

A uniform resource locator (URI) is used to exchange information between a web client (such as a web browser) and a web server. The structure of these names is agreed upon via various standards. When constructing a URI like the one that I was asked to analyze, there is protocol part ("http" in this case, which indicates the hypertext transport protocol *without* end-to-end encryption, which is no longer the norm but was during the specific timeframe.)

This is followed by a domain name ("appft1.uspto.gov"). This name is dynamically translated to an IP address, which is how the messages between the web client and server are exchanged. The mapping of names to addresses can (and does) change over time. In this case appft1 is no longer a valid server name so this URL is no longer working.

Following the server's name are a series of elements separated via a forward slash ("/") character, which is used to navigate the namespace of resources the web server presents to the web client. Often these correspond to files and directories in a file system on the web server, though that is not strictly required.

Following this name is a question mark ("?") which indicates that the information included in the URL after the question mark is metadata for the web server's use. It normally does not correspond to the structure of data in a file system and instead is often related to the structure of data in a database.

Note: while I suggest the database relationship because it is a common one, it is not required, and the specific meaning of that data is determined by the receiving web server.

By using archive.org (the "wayback" machine) I was able to review older versions of the USPTO website and, in turn, to generate URLs that had a similar structure to the URL provided to me. While I did not do an exhaustive analysis, I was able to confirm that this general structure is consistent with the data present in this URL; given sufficient time and experimentation I expect that I would be able to generate this URL by properly picking the search fields.

To do this, I used the following URI:

https://web.archive.org/web/20130701212614/http://patft.uspto.gov/netahtml/PTO/search-bool.html

This is an automated capture of a version of the USPTO website, and it continues to be sufficiently functional that I was able to confirm the general structure.

While the URIs it generates are no longer valid, based upon my own experience in using the USPTO website over the past two decades I am familiar with the website and in my opinion the URI I was asked to review is likely to have been a valid URI at the time it was generated.

E-Mail Retention

In my career, I have been responsible for managing and maintaining e-mail servers. While not at the size and scope of Microsoft's systems, I am familiar with concepts such as retention policies, litigation holds, and the importance of electronic record keeping. I have also been involved with retention holds during active investigations (e.g., the Securities and Exchange Commission) as well litigation hold mechanisms that retain documents indefinitely.

I am not an attorney, so I do not speak from a nuanced understanding of the law. Instead, my perspective is from the technology side of e-mail management, where the relevant policies are implemented by IT staff, even when the details of the policy are crafted by those familiar with the legal and business requirements.

Based upon my own experience, I know that it is customary to preserve critical employment records indefinitely. This would include essential documents like employment agreements, disclosures, etc. I know that the EEOC requires records be kept for at least one year following an involuntary termination (see https://www.eeoc.gov/employers/recordkeeping-requirements.) While I realize the text says they must be kept for one year, I do not know of any employer that would be able to properly comply with the keeping of records for "one year following involuntary termination" at any time prior to the employee's termination; thus, effectively a rule stating that such records must be kept.

From a business management perspective, I would expect any enforceable contract to be maintained indefinitely. For example, a "work for hire" agreement that an employee signed would be kept for the lifetime of any software they developed, to ensure the ability to definitively prove ownership of copyright.

Microsoft would also be subject to rules applicable to government contractors, as Microsoft has extensive relationships with the U.S. government based upon my personal knowledge. See

https://www.dol.gov/agencies/ofccp/faqs/electronic-records for a detailed listing of the requirements the U.S. Government applies.

Thus, it would be reasonable to assume that Microsoft seeks to be in compliance with their legal obligations to retain electronic records, which would include e-mail communications.

Retention policies are something Microsoft itself would control. In some cases, they are externally dictated (e.g., SOX compliance).

I would note that Microsoft's current default retention policies for Exchange Online (https://learn.microsoft.com/en-us/exchange/security-and-compliance/messaging-records-management/default-retention-policy) suggest that the default is two years, with a "move to archive" at the end of this period. These policies can be modified by a company but are a reasonable assumption of "default" behavior.

Of course, Microsoft should have initiated a litigation hold on any related documents once they were aware of potential litigation as this would be in keeping with their legal obligations. This functionality has been available in Exchange for quite a long time, and while it has evolved somewhat (see https://learn.microsoft.com/en-us/exchange/security-and-compliance/in-place-and-litigation-holds) the basic idea remains the same: Microsoft has a legal obligation to retain email once they think something will be subject to litigation.

Thus, based upon my experience administering e-mail systems, as well as maintaining corporate records, particularly those related to the ownership of intellectual property – a critical element of my own work in the technology industry since 1979 – I would reasonably expect that they would have copies of all such relevant documents as an ordinary matter of course.

Based upon my personal experience with Microsoft, I know that the long-term storage of documents is of paramount concern, and they continue to be on the forefront of developing new technologies capable of storing critical information for millennia (see https://www.microsoft.com/en-us/research/project/project-silica/ for example.)

Limitations

Please note that this is not a formal report, and that while the opinions that I have expressed are correct relative to my knowledge and analysis of the specific facts, they are subject to change upon a formal review, drafting of a report, and more detailed examination of additional evidence.

Sincerely,

W Anthony Mason

Digitally signed by W Anthony Mason
Date: 2024.03.15 21:25:31 -07'00'

W. Anthony Mason